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Professional Development

Stephanie Hirsh, **Joellen Killion**, **Joyce Pollard**

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Introduction

The span of professional development research literature reveals, arguably, three trends. Literature of the earliest phase, largely during the 1970s and 1980s—the era of the "search for the perfect workshop"—was characterized more by a focus on evaluations of teacher satisfaction with professional development than an examination of long-term outcomes of professional development. The second phase, from the 1990s to the early 2000s, reflects a shift in research focus to the identification of characteristics of effective professional development experiences. Many studies of school improvement and education reform named *professional learning*—with a focus on educator learning as an ongoing process rather than a one-time event—as one of the top five components of reform efforts. A research base enriched by examinations of schools as places of work and learning sought to clarify what was known about teachers' own learning and the effects on their practice, and ultimately, on student learning. Thus, the third, and current, phase examines the role professional an educator's own learning plays in a dynamic, complex system of professional learning. New technologies have also advanced to support educator learning. Since the 1990s, many studies confirm that a strong relationship exists between teacher practice and student learning. Research of some models concludes that professional learning positively influences teacher practice. Studies of school and district leadership suggest a relationship also exists among leadership practices, teaching effectiveness, and student learning. Some findings conclude that there is a relationship between professional learning and student achievement. The literature about effective schools identifies collaboration among educators and professional learning as two characteristics that consistently appear in schools that substantially increase student learning. Some studies of the effects of professional learning have also produced statistically insignificant results on teacher practice or student achievement when measured over a brief period of time, usually a single year. As a result of the new decade of research, understanding about what distinguishes effective professional learning is growing clearer. Accordingly, Learning Forward undertook a third revision of the Standards for Professional Learning in 2011. This article is organized to help graduate students, education scholars, and professional development leaders, practitioners, and facilitators navigate the landscape of scholarship about effective professional development activities, policies, and structures that contribute to a system of professional learning. The structure of this article organizes supporting literature, first, in sections that trace the problems and promises of early professional development literature through studies of effective professional development. Sections follow with references to literature about professional development and results for teacher practice and student outcomes. The remaining sections of the bibliography correspond to each of the seven standards: "Learning Communities," "Leadership," "Resources," "Data," "Learning Designs," "Implementation," and "Outcomes."

General Overviews

By their nature, professional development and school improvement share such complexities that various methods of research and evaluation have evolved to describe what happens within and among the related processes of learning and improvement. Most often the purpose of research is to seek knowledge about teaching and leadership practices, and to determine which of those practices are more and less effective. In general, professional development and school improvement literatures include the following: (a) descriptive (naturalistic) observational studies in which district and school programs are visited and observations provide the information for the depictions of programs and initiatives, implementation, and effects on curriculum and instruction; (b) descriptions of naturalistic events generated through interviews and questionnaires administered to personnel; (c) experimental studies in which alternative designs are

implemented and assessed; and (d) syntheses and theoretical positions created by scanning the studies. This section includes three subsections that take a historical approach: The first includes sources that review the professional development research literature. It notes that the prevalent model of the time—professional development as "training"—had conceptual limitations. And while the literature, for the most part, has shifted from framing professional development as training, reports still emerge that call for efforts that will "teach the teachers," especially during periods of reform. The second subsection contains references to the "foundational literature research" of the 1990s, which tests the core features of effective professional development, while the third section contains resources that represent the movement of the late 1990s toward a more empirical examination of effective professional development. In all three subsections the research reviews and studies were chosen for their breadth, their contribution to the knowledge base about the core features of effective professional development, and their influences on the development of standards for professional learning. Finally, for readers interested in literature that articulates the consensus among researchers about the features of effective professional development, this subsection includes reviews calling for a new paradigm of professional development (e.g., National Commission on Teaching and America's Future 1996 and Sparks and Hirsh 1997, both cited under A "New Paradigm").

Professional Development and Reform: More Than "Training"

At the core of these articles demonstrates a recognition and papers is the recognition that the different relationships exist among professional development, teacher learning, content knowledge, and student outcomes were different than they had been described in much of the literature up until the time of publication. For example, Little 1993 points out that teacher professional development conceptualized as information delivered to the good employee for improvement of skills (i.e., a training model) has limitations in its impact on a teacher's own learning and, thus, on practice and student learning. In identifying such problems with the prevailing conceptualizations of professional development, Little 1993, together with Corcoran 1995, also points the way to a more complex relationship between professional development and the teacher's own learning to be investigated through increasingly robust research designs. The extensive research review in Sparks 1983 introduces the context-process-content structure as a way of organizing the research that serve as the basis for each of the professional development standards as defined since 2001. And while the literature, for the most part, has shifted from framing professional development as "training," reports still emerge that call for efforts that will "teach the teachers," especially during periods of reform. Those reports tend to include wide-ranging reviews of the evolving ideas about teacher professional development from training to staff development to professional learning. Students of education reform will want to read Goertz, et al. 1995, a study that examines teacher learning, school organization, and change, and compare it with Gulamhussein 2013, which calls for developers to create and provide effective professional development based on how teachers learn. The result would be professional learning that develops discipline-specific concepts and skills and prepares teachers to respond to the demands of "a trio of potent reforms" (p. 1): higher academic standards, teacher evaluations, and high-stakes standardized tests.

Corcoran, T. 1995. *Helping teachers teach well: Transforming professional development*. CPRE Policy Briefs. New Brunswick, NJ: Eagleton Institute of Politics, Rutgers Univ.

This policy brief excerpts material from Corcoran's research study published by the National Governor's Association. It reviews research about *effective* professional development that was emerging at the end of the first decade of systemic reform, and it paves the way for many of the studies cited in this article.

Goertz, M., R. Floden, and J. O'Day. 1995. *Studies of education reform: Systemic reform*. Vol. 1. *Findings and xonclusions*. New Brunswick, NJ: National Center for Research on Teacher Learning.

While broader in scope than professional development alone, this three- phase study of systemic reform builds on previous studies of teacher learning as a core issue within the systemic reform movement. Volume 1 pays particular attention to policy linkages between curriculum reform and teacher learning. Published in conjunction with the National Center for Research on Teacher Learning, Michigan State University.

Gulamhussein, A. 2013. *Teaching the teachers: Effective professional development in an era of high stakes accountability*. Alexandria, VA: National Schools Boards Association.

Reviews literature about effective professional development in light of current reforms: Common Core state standards, accompanying standardized tests, and teacher evaluations. If teachers are to elevate critical thinking among skills required for students, they need effective professional development that supports their dual roles of technician and intellectual.

Little, J. W. 1993. Teachers' professional development in a climate of reform. *Educational Evaluation and Policy Analysis* **15.2: 129–151.**

Little calls the dominant "training" model inadequate for teaching practices implicit in contemporary reform initiatives. She posits that subject matter collaborations and other emerging structures embody principles addressing demands of reforms: equity, assessment, school organization, and professionalization of teaching. The principles provide criteria for assessing policies and practices about professional development.

Sparks, G. 1983. Synthesis of research on staff development for effective teaching. *Educational Leadership* **41.3: 65–72.**

This early review codifies appropriate content and context for staff development with a focus on the "training processes" of staff development: diagnosing and prescribing, giving information and demonstrating, discussing application, and coaching. Selected research presents an argument for adapting staff development programs to fit different teacher characteristics and attitudes.

A "New Paradigm"

For those interested in a solid collection of references about the emerging shift in thinking about schools as places where teachers also learn as part of their work, the review and research in Smylie 1995 describe professional development that was primarily school-based, or at least focused on the workplace and day-to-day work of teaching as well as centered on student outcomes rather than on new curricular approaches for their own sake, as discussed in Newmann and Wehlage 1995. The notion that professional development should be considered as part of a system of learning, in particular, a system of professional learning, is made explicit in a report, the National Commission on Teaching and America's Future 1996. The commission's view is both long-range in considering the development of teachers' skills and knowledge throughout a teaching career and multilevel in stretching across state and federal education systems. With a focus on accountability, the authors promote standards and outcomes for student and teacher learning. A book monograph published the following year, Sparks and Hirsh 1997, delves further into the influence of systems thinking on the development of vision of professional development beyond a series of "trainings" to a coherent system of professional learning focused on student outcomes. These works contain the core ideas regarding the structures, processes, and content that are addressed in the professional learning standards, most notably, the standards of Learning Communities, Learning Designs, Resources, Data, and Outcomes.

National Commission on Teaching and America's Future. 1996. *What matters most: Teaching for America's future.* **New York: National Commission on Teaching and America's Future.**

This landmark report calls for a systemic change in how teachers are prepared, recruited, and supported in American schools. The commission proposes creation of a new "infrastructure for professional learning and an accountability system that ensures attention to standards" for educators and students from the classroom level to the national level.

Newmann, F., and G. Wehlage. 1995. *Successful school restructuring: A report to the public and educators.* **Madison, WI: Center on Organization and Restructuring of Schools.**

Monograph reviews research on conditions that enhance student learning and enable schools to function as professional communities: shared governance that increases teachers' influence over school policy and practice, scheduling that encourages collaboration, staff development that strengthens teacher skills, and deregulation that provides school autonomy, small school size, and parent involvement.

Smylie, M. A. 1995. Teacher learning in the workplace: Implications for school reform. In *Professional development in education: New paradigms and practices.* **Edited by T. R. Guskey and M. Huberman, 92–113. New York: Teachers College.**

Essay addresses professional development's "social-psychological/institutional factors." Describing schools as "not only places where teachers work. . . but. . . as places where they learn" (p. 95), Smylie draws on theory and practice to discuss optimum workplace conditions, including balancing a coherent reform focus with learner autonomy and collaboration to support effective professional learning.

Sparks, D., and S. Hirsh. 1997. *A new vision for staff development.* **Alexandria, VA: Association for Supervision and Curriculum Development.**

This book discusses three ideas that changed staff development: results-driven education, systems thinking, and constructivism. A foundational treatise about a new paradigm of professional development, it examines staff development's evolution from fragmented "training" to coherent, planned staff development focused on student learning in a school-based or job-embedded setting.

Effectiveness

This section describes selected major research studies, including several that use international data sets to examine or test the associations between features of effective professional development and outcomes. For a good foundation in the literature of effective professional development, readers will need to know the federally funded Title II Eisenhower Professional Development grants, the large-scale study Garet, et al. 1999 because of its contribution to the empirical knowledge base about the core features of effects of teacher professional development. It also serves as the basis of several research studies included in later sections of this article. Students and scholars should know that, ten years later, Desimone 2009, by one of the authors of the large-scale "Eisenhower Study," makes a case for the existence of a research consensus about the core features of effective professional development. The extensive research synthesis in Timperley, et al. 2007 describes research in New Zealand and the United States focusing on characteristics of teacher professional development experiences that contributed to achievement gains for diverse student learners. Several informative studies, including Wei, et al. 2010 and Barber and Mourshed 2007, examine data and other evidence from several international jurisdictions (e.g., nations, states, provinces) to determine the policy structures and resulting conditions of teacher professional learning and student learning. Mourshed, et al. 2010 offers thorough research reviews and secondary analyses of international data sets—the Programme for International Student Assessment and the Third International Math and Science Study of the Organisation for Economic Co-operation and Development (OECD)—to compare conditions of teaching and learning. Wei, et al. 2010 measures progress of selected states' professional development access during several administrations using eleven indicators drawn from the Schools and Staffing Survey (SASS) data. As a secondary analysis with a broad reach, Wei, et al. 2010 "unpacks" some of the associations between teachers' formal and informal learning experiences in the workplace. For practice-oriented applications, policymakers, the general public, college instructors and facilitators of professional development will find Hirsh and Killion 2007 informative, as is Mizell 2010, a concise review. Mizell 2010 functions as a primer that answers basic questions about what constitutes effective professional development for teachers and principals and what evidence exists about how professional development makes a difference in learning outcomes. In a review of several strands of literature about professional development and teacher learning, Opfer and Pedder 2011 challenges the process-product premise of the effectiveness literature. The authors argues for a shift in the conceptual framing of professional development and teacher learning from a cause-and effect approach to causal explanation, so that researchers, practitioners, and decision makers may better understand under what conditions, why, and how teachers learn.

Barber, M., and M. Mourshed. 2007. *How the world's best-performing school systems come out on top.* **London: McKinsey.**

This report presents a substantive analysis of the OECD's Programme for International Student Assessment (PISA) as well as interviews with international education experts, policymakers, and practitioners. In an analysis of OECD's international data sets, the authors discuss comparisons of the effects of teachers' access to professional learning on quality teaching and learning.

Desimone, L. M. 2009. Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. *Educational Researcher* **38.3: 181–199.**

Desimone argues that an empirical research base exists to support the identification of core features of effective professional development and a core conceptual framework for studying effects of professional development. She describes those features and argues that we should use that framework as a base for studies of professional development effectiveness.

Garet, M. S., B. F. Birman, A. C. Porter, L. Desimone, and J. Herman. 1999. *Designing effective professional development: Lessons from the Eisenhower program [and] technical appendices.* **Washington, DC: US Department of Education.**

This first large-scale empirical study of federally funded professional development is notable for its consideration of the effectiveness of professional development. Researchers used regression modeling to examine how core structural components of professional development funded through the Eisenhower math and science program led to self-reported changes in teachers' knowledge and practice.

Hirsh, S., and J. Killion. 2007. *The learning educator: A new era in professional learning.* **Oxford: National Staff Development Council.**

This book identifies eight principles that serve as the foundation for effective professional learning. They are principles, leadership, impact, results, goals, collaboration, evaluation, and expertise. Each principle is supported with research and described in practice. The book outlines the next decade's, i.e., 2007–2017, agenda for improving educator professional learning.

Mizell, H. 2010. *Why professional development matters.* **Dallas: Learning Forward.**

Drawing on research and theory, the author in this pragmatic essay answers basic questions about what research evidence says constitutes effective teacher and principal professional development and what districts must do to ensure quality professional and student learning.

Mourshed, M., C. Chijioke, and M. Barber. 2010. *How the world's most improved school systems keep getting better.* **New York: McKinsey.**

This report builds on Barber and Mourshed 2007 to analyze the experiences of nearly 575 reform interventions made across the globe in twenty school systems. To deepen understanding of the interventions and how they interacted to improve student outcomes, the authors include appendixes with extensive data.

Opfer, V. D., and D. Pedder. 2011. Conceptualizing teacher professional learning. *Review of Educational Research* **81.3: 376–407.**

This review of two hundred resources proposes to conceptualize teacher learning as a complex system with interactions among the teacher, the school context, and the learning activities themselves. This conceptual frame offers explanations for the difficulties of conducting research about processes and results of teacher learning. Also suggests methodologies for future research.

Timperley, H., A. Wilson, H. Barrar, and I. Fung. 2007. *Teacher professional learning and development: Best evidence synthesis iteration (BES)*. **Wellington, New Zealand: Ministry of Education.**

This research synthesis of ninety-seven core and supplementary studies from international and New Zealand databases seeks to "unpack" what is known about how teachers interpret learning contexts and use skills offered during professional development activities as well as the consequent impacts on their teaching practice and student outcomes.

Wei, R. C., L. Darling-Hammond, and F. Adamson. 2010. *Professional development in the United States: Trends and challenges*. **Dallas: National Staff Development Council.**

The second report from a three-phase research study presents secondary analyses of selected international data sets to establish benchmarks for assessing progress in professional development over time. The authors recommend further research. Appendixes contain details of methodologies and data analyses.

Journals

The lists in this section give readers access to the journals consulted in drafting this article. They are selective lists that include periodicals relevant for dissemination of research and analyses about education, in general, and about policy and practice in the system of professional learning, in particular. The publications, which vary by audience and knowledge domain, reflect the complexity inherent in the field of professional development, and they also treat the new domains of research applied to the study of professional learning.

Research

Practitioners, students, and other researchers will look to the *American Educational Research Journal* for original research about, and for, the improvement of education processes and outcomes. Also included in the American Education Research Association scholarly publishing portfolio is *Educational Researcher*, which offers readers an even more general coverage of programmatic articles and research methodologies. The *Elementary School Journal* is appropriate for practitioners and decision makers who seek articles drawn from the latest research in child development, cognitive psychology, sociology, and anthropology. The *Journal of Applied Developmental Psychology* provides readers with information on how researchers apply cognitive sciences to better understand the nature of learning, particularly adult learning in a professional setting. Readers can use *Review of Educational Research* to retrieve reviews, syntheses, meta-analyses, and conceptual discussions, some of which reframe professional development from a focus on delivery of content to the support of professional learning. The *Review of Research in Education* is an annual publication useful to students, practitioners, and analysts who are tracking or researching current education trends. The 112-year old *Teachers College Record* is ideal for readers who are seeking commentaries and research literature with a strong focus on applications in practice—professional development to increase pedagogic content knowledge in specific subject areas—especially for the intersections between policy and teaching practice. Likewise, readers interested in applications of empirical research will be greatly informed by *Teaching and Teacher Education*. Because of its multidisciplinary approach and international perspectives, policymakers should consider it a resource for reviewing evaluations and other theoretical or applied research studies related to teaching. A relatively new international resource is the *Journal of Education and Training Studies*. This open-access journal offers students discipline-specific research studies in a wide range of education topics.

American Educational Research Journal. **1964–.**

This flagship journal of the American Education Research Association publishes original empirical and theoretical studies and analyses in education that constitute significant contributions to the understanding and/or improvement of educational processes and outcomes.

Educational Researcher. **1972–.**

One of the official journals of the American Education Research Association, it publishes scholarly articles that are of general significance to the education research community.

Elementary School Journal. 1900–.

Published by the University of Chicago, this is an academic journal that publishes articles dealing with education theory and research and their implications for elementary and middle school teaching practice. The journal also presents article on research in child development, cognitive psychology, and sociology as it relates to teaching and learning.

Journal of Applied Developmental Psychology. 1980–.

Published by Elsevier, the journal focuses on two key concepts: human development and application of knowledge "derived from investigating variables in the developmental process" so that knowledge gained from research may be applied to policymaking and in educational settings.

Journal of Education and Training Studies. 2013–.

Published monthly in print and online versions by Redfame Publishing, this is an international, peer-reviewed, open-access journal that covers research articles, specifically in consumer education, critical pedagogy, curriculum and instruction, educational leadership, education philosophy, education psychology, educational technology, and distance education.

Review of Educational Research. 1931–.

Published quarterly by the American Educational Research Association, this peer-reviewed journal publishes critical reviews of research literature bearing on education, including conceptual articles and syntheses of literature from fields broadly relevant to education and educational research.

Review of Research in Education. 1973–.

This peer-reviewed journal provides an annual overview of work in the field and descriptive analysis of selected topics from research literature. It promotes discussion of research problems.

Teachers College Record. 1900–.

Published by Teachers College, Columbia University as a journal of "research, analysis, and commentary in the field of education."

Teaching and Teacher Education. 1985–.

This peer-reviewed journal is dedicated to presenting a range of disciplinary approaches that deal with teachers, teaching, or teacher education from an international perspective or in an international context. Published eight times a year, the journal encourages varied approaches to empirical research, conceptual analyses, and qualitative or quantitative literature reviews.

Policy and Practice

The journals in this subsection also publish research articles. The subsection heading refers in large measure to readers' uses or applications of the knowledge and information to problems of policy and practice related to professional development. Focusing on

policy implementation and analysis, *Educational Evaluation and Policy Analysis* is a resource for decision makers and analysts interested in program evaluations. Decision makers and school or teacher leaders will use the *Journal of Curriculum Studies* to monitor issues of theory, policymaking, and practice in all areas of curriculum and teaching for elementary and secondary schools as well as of teacher education for the schools. For administrators and researchers tasked with determining actual costs of professional development, the *Journal of Education Finance* covers finance models and frameworks applicable for assessing the value of professional development investments. The *Journal of Economic Perspectives* gives students and other readers lessons drawn from economics research and applied to other contexts, especially the public policy arena. The *Journal of Research in Science Teaching* publishes reports for science education researchers and practitioners on issues of science teaching and learning and science education policy. For practitioners and policymakers, and for professional development administrators who are interested in deepening their understanding of the standards for professional learning, the *Journal of Staff Development* offers research-based articles about leaders, including teacher leaders, who are creating conditions for effective professional learning. For teacher educators, education students, and practitioners, the *Journal of Teacher Education* covers topics such as field experiences and teacher education; selection, retention, and recruitment of minority teachers and teacher leadership; teacher beliefs; and restructuring teacher education. *Child Development* is an international, multidisciplinary journal for educators, mental health practitioners specializing in work with youngsters, teacher educators, and professional development leaders. It is a vital source for research about early development, and it includes articles, essays, and reviews that can inform policy and practice.

Child Development. 1930–.

This is the flagship journal of the Society for Research in Child Development published bimonthly and spanning disciplines and national borders to examine many aspects of development from prenatal to adolescence. Articles address not only researchers and theoreticians, but also a wide range of child medical and educational practitioners.

Educational Evaluation and Policy Analysis. 1979–.

Another official journal of the American Education Research Association, it publishes theoretical, methodological, or policy articles for readers engaged in educational policy analysis, evaluation, and decision making.

International Journal of Mentoring and Coaching in Education. 2012–.

This peer-reviewed journal publishes articles about research, theory, and emerging issues related to mentoring and coaching in schools, colleges, and universities, with a focus on specific contexts. The journal examines the development of coaching and mentoring practices worldwide.

Journal of Curriculum Studies. 1968–.

This peer-reviewed journal publishes six times a year on all aspects of curriculum studies, pedagogic theory, teacher education and development, assessment and evaluation, and issues about schooling. According to the publishers' website, the journal is interested in articles that examine international perspectives of curriculum.

Journal of Economic Perspectives. 1987–.

Published by the American Economic Association, the journal supports the synthesis and integration of lessons learned from several lines of economic research and the dissemination of issues in economics to academic and general audiences.

Journal of Education Finance. 1975–.

Published by the University of Illinois Press, this is a blind review scholarly journal. Articles cover original research and analysis on

topics such as education reform, judicial intervention in finance, school/social agency linkages, tax limitation measures, and factors influencing teacher salaries.

Journal of Research in Science Teaching. **1963–.**

The official journal of the National Association for Research in Science Teaching (NARST), it publishes articles that advance the understanding of science teaching and learning and are likely to have a significant impact on the field of science education and science education policy.

Journal of Staff Development. **1994–.**

Renamed in 2003, it is the flagship publication of Learning Forward, the international association of learning educators. This peer-reviewed journal publishes articles that demonstrate applications of professional development research in practice and implications for policymakers.

Journal of Teacher Education. **1950–.**

This peer-reviewed journal publishes empirical and conceptual scholarship in teacher education as well as policy and position papers, analyses of practice, and syntheses of the literature on important topics in the field.

Results of Effective Professional Development

This section is divided into two subsections that represent the shift in research focus to the results of professional development rather than simply the form of professional development. Each of the subsections refers to literature about the impact of professional development on teacher practice and student achievement as measured by standardized tests, in most cases. Six of the eight resources, all empirical studies conducted during the past decade, were chosen because of their designs, rigor of their analyses, and authority of the authors. One conceptual article reporting the application of cognitively guided instruction model applied in mathematics classrooms was chosen because of its design; the seventh resource, a research-based report, was chosen because of the theoretical scope, resulting design, and methodology as well as international perspective.

Teacher Practice

This subsection discusses selections from the literature about the relationship of professional learning development to teachers' instructional practices. The focus of these articles falls in two groups: articles examining the impact of professional development approaches on teacher practice, and articles discussing the effect of teachers' learning from one another or working together on instructional practice and student performance. Professional development has proven to be such a complex concept to define operationally that empirical research was best conducted in subject matter areas, particularly mathematics and science teaching. Two important studies in subject matter–related professional development examine influences on teacher practices within classrooms. Desimone, et al. 2002, one of the scholarly works resulting from the authors' longitudinal study that identified features of effective professional development, examines the relationship between professional development in mathematics and science and subsequent teacher instructional practices. Students will also want to read the later study, Garet, et al. 2010, that describes results of teacher practice in middle school after the first year of math/science professional development. Another articles about teacher practice in mathematics will enlighten students and practitioners about the types of knowledge teachers must have for effective instructional practice. Carpenter, et al. 1996 considers how teachers use conceptual frameworks to guide their understanding of how students think about mathematics and adjust their practice. With a focus on pedagogical content knowledge, Guskey 2002 describes the "model of teacher change" and is notable for transposing the sequence of relationships so that teacher change in beliefs is a function of improved student achievement rather than the converse. Bautista, et al. 2015 describes the relationship between teachers' understanding and use of graphs while and after completing professional development about the use of such representations in class. Fishman, et al. 2003

establishes conceptual, empirical, and normative properties of quality teaching, and Jackson and Bruegmann 2009; Leana 2011; and Sun, et al. 2013 shows the impact of "effective" teachers on the reading and math test scores of the students of their peers. Teacher education leaders will be interested in two resources that address teacher education and systemic influences that shape teacher practice in a consistent, coherent, and continual way. Ball, et al. 2009 raises important questions about the need to establish a professional curriculum in mathematics education and Even and Ball 2010 compares international research and practice in teacher education, induction, and development. See also Carpenter, et al. 1996.

Ball, D. L., L. Sleep, T. Boerst, and H. Bass. 2009. Combining the development of practice and the practice of development in teacher education. *Elementary School Journal* **109.5: 458–474.**

Article discusses two central problems of teacher education: the lack of (1) shared mathematics education professional curriculum and (2) support for teacher education instructors. Describes the efforts of the authors to address the problems, analyzes features of the professional curriculum, relates them to the problems, and considers issues of transferability to other contexts.

Bautista, A., M. C. Cañadas, B. M. Brizuela, and A. D. Schliemann. 2015. Examining how teachers use graphs to teach mathematics during a professional development program. *Journal of Education and Training Studies* **3.2: 91–106.**

Examines effect of graduate courses on teaching practices of fifty-six mathematics teachers (grades 5–9) in three US states. Blended courses let teachers reflect and discuss online and face to face. Despite methodological limitations, findings confirmed literature on discipline-specific PD: teachers used graphs earlier, more often, and more effectively.

Carpenter, T. P., E. Fennema, and M. L. Franke. 1996. Cognitively guided instruction: A knowledge base for reform in primary mathematics instruction. *Elementary School Journal* **97:3–20.**

Authors discuss how the CGI model gives teachers a framework with which to construct a coherent pedagogical content knowledge base. The analysis examines teachers' applications of the model to interpret, transform, and reframe more broadly their informal or spontaneous knowledge about students' mathematical thinking.

Desimone, L. M., A. C. Porter, M. S. Garet, K. S. Yoon, and B. F. Birman. 2002. Effects of professional development on teachers' instruction: Results from a three-year longitudinal study. *Educational Evaluation and Policy Analysis* **24.2: 81–112.**

This article discusses a nationwide empirical study examin effects of features of professional development on math/science instruction. Using a purposefully selected sample of 207 teachers in thirty schools within ten districts in five states, the authors identified patterns of characteristics of high-quality professional development, including a focus on curriculum/instruction and active forms of learning.

Even, R., and D. Ball, eds. 2010. *The professional education and development of teachers of mathematics: The 15th ICMI study.* **New York: Springer.**

This study presents the output of international work—development, research, theory, and practice—related to professional education of mathematics teachers in twenty regions across the globe. The study addressed issues related to teacher education and development in teacher preparation and early teaching years and professional learning for and in practice.

Fishman, B. J., R. W. Marx, S. Best, and R. T. Tal. 2003. Linking teacher and student learning to improve professional development in systemic reform. *Teaching and Teacher Education* **19:643–658.**

This article draws on one of the research studies that has contributed to the literature by identifying linkages among the design and implementation of professional development, teacher practice, and student learning outcomes.

Garet, M., A. Wayne, F. Stancavage, et al. 2010. *Middle school mathematics professional development impact study: Findings after the first year of implementation*. **NCEE 2010–4009. Washington, DC: Institute of Education Sciences.**

This reports on a rigorous test of the impact of a professional development program for teachers of middle school mathematics in seventy-seven mid- and high-poverty schools (twelve participating school districts). After year one, the impact of the program was mixed relative to teacher knowledge, teacher practice, and student achievement.

Guskey, T. R. 2002. Professional development and teacher change. *Teachers and Teaching: Theory and Practice* **8.3–4: 381–391.**

Describes the "model of teacher change," which proposes that change moves from (1) professional development to (2) change in classroom practices to (3) change in student learning to (4) change in teachers' attitudes and beliefs. Discusses new evidence supporting the model, with implications for staff development planning, implementation, and evaluation.

Hattie, J. 2015. *What works best in education: The politics of collaborative expertise*. **Open Ideas. New York: Pearson Education.**

Report focuses more on a model for collaboration, rather than learning among teachers, and proposes eight specific tasks to make it a reality. Hattie says differential expertise exists across schooling systems with wide variation within schools; however, developing and nurturing collaborative expertise can reduce the variance.

Jackson, C. K., and E. Bruegmann. 2009. Teaching students and teaching each other: The importance of peer learning for teachers. *American Economic Journal: Applied Economics* **1.4: 1–33.**

This study examined more than ten years of elementary teacher and student data to determine if teachers' peers affected the test scores of their own students. Regression analysis indicated that students have larger achievement gains in reading and math when their teachers have more effective colleagues.

Leana, C. 2011. The missing link in school reform. *Stanford Social Innovation Review* **(Fall): 30–35.**

In a two-year investigation of 1,014 fourth- and fifth-grade teachers and the one-year changes in student mathematics achievement scores, researchers found that when teachers worked with high-ability teachers in purposeful, content-focused interactions, instruction improved, student scores improved, and low-ability teacher performance improved.

The New Teacher Project. 2015. *The mirage: Confronting the hard truth about our quest for teacher development*. **Brooklyn, NY: TNTP.**

Examines outcomes of PD programs across three large school districts and one midsize charter network. No reliable relationship emerged between teacher improvement and PD in public districts. In the charter network, steady improvement correlated with culture of excellence; development embedded throughout the school culture; focus on improvement; alignment and efficiency.

Sun, M., W. R. Penuel, K. A. Frank, H. R. Gallagher, and P. Youngs. 2013. Shaping professional development to promote the diffusion of instructional expertise among teachers. *Educational Evaluation and Policy Analysis* **35.3 (April): 344–369.**

This study provides empirical evidence that effective professional development has a positive significant impact on instructional practices not only for those who directly experience professional development, but also for colleagues who receive help and support from those who have participated directly and thus gained expertise.

Student Achievement

Education research that measures the effects of improving teacher preparation and development of teacher knowledge and skills on change in student achievement has developed and expanded since the 1990s. The resources in this section addressing relationships between professional development and student achievement have been chosen because of their scope; they include large-scale meta-analyses, secondary analyses, or empirical studies that point to linkages among professional development, teacher practice, and student achievement. Some of the literature begins to describe the impact of teachers' collaborative learning on student learning. Beginning in the early part of the 1990s, US Department of Education Professional Development Team 1994 describes the features of professional development found through research at the time. By the end of the decade, Cawelti 1999 expands on the literature to focus on classroom practices that research suggests will improve student achievement. Those interested in this area will want to read the studies that represent research efforts of the decade of the 2000s to make the link between teachers' choices of classroom practices and student achievement, beginning with Wenglinsky 2000. Other studies, including Gruenert 2005; Goddard, et al. 2007; Blank and de las Alas 2009; and Darling-Hammond, et al. 2009, report a positive relationship between a collaborative teaching culture and student achievement. Administrators and practitioners working toward standards-based education systems today will want to read Hirsh 2010, which offers procedural questions to help readers examine the issues and needs of professional development for student-assessment systems.

Blank, R. K., and N. de las Alas. 2009. *Effects of teacher professional development on gains in student achievement: How meta analysis provides scientific evidence useful to education leaders*. Washington, DC: Council of Chief State School Officers.

This meta-analysis identified sixteen professional development studies (from 416) that met rigorous criteria. The analysis shows cross-study evidence that teacher professional development has positive effects on student achievement. It also confirms earlier research documenting positive relationships of key characteristics of professional development program designs with student outcomes.

Cawelti, G. 1999. *Handbook of research on improving student achievement*. 2d ed. Arlington, VA: Educational Research Service.

This handbook identifies classroom practices that research suggests will result in higher student achievement. The premise is that instructional improvement must begin with the knowledge base about effective teaching and learning. It includes integrated approaches within disciplines, and each chapter contains a reference list.

Darling-Hammond, L., R. C. Wei, A. Andree, N. Richardson, and S. Orphanos. 2009. *Professional learning in the learning profession: A status report on teacher development in the United States and abroad*. Dallas: National Staff Development Council.

This comparative report, the first of a four-phase study, discusses secondary analyses of selected international data sets to examine professional development that supports professional learning and leads to practices resulting in improved student outcomes. Findings suggest that US teachers have limited access to such learning opportunities.

Goddard, Y., R. D. Goddard, and M. Tschannen-Moran. 2007. A theoretical and empirical investigation of teacher collaboration for school improvement and student achievement in public elementary schools. *Teachers College Record* 109.4: 877–896.

Study empirically tests relationships between teacher collaboration and student achievement. Survey data were collected from forty-seven elementary schools, 452 teachers, and 2,536 fourth-grade students in one large school district. Results of HLM analyses indicate higher student achievement in mathematics and reading from schools showing higher levels of teacher collaboration.

Gruenert, S. 2005. Correlations of collaborative school cultures with student achievement. *NASSP Bulletin* **88.645: 43–53.**

This study conducts a regression analysis of 2,750 elementary, middle, and high school teachers from eighty-one schools, correlating factors with student achievement data from state standardized tests. Analyses show the highest correlations come from three of six factors: professional development, unity of purpose, and learning partnerships.

Hirsh, S. 2010. *Building professional development to support new student assessment systems.* **Washington, DC: Arabella Philanthropic Investment Advisors.**

This literature review applies the research about critical components of effective professional development to the planning and implementation of statewide assessment systems.

US Department of Education Professional Development Team. 1994. *Building bridges: The mission and principles of professional development.* **Washington, DC: US Department of Education.**

Authors synthesize research to derive principles for high-quality professional development. Key factors included considering teachers central to student learning, integrating best available research and practice, promoting teachers' continuous inquiry and improvement, providing substantial time and resources, creating a coherent plan, and assessing the impact on teacher effectiveness and student learning.

Wenglinsky, H. 2000. *How teaching matters: Bringing the classroom back into discussions of teacher quality.* **Princeton, NJ: Educational Testing Service.**

This monograph analyzes data from the National Assessment of Educational Progress to examine influences of classroom practices, professional development, and teacher input on student achievement. The strongest relationship is between classroom practices, followed by professional development that is specifically tailored to those classroom practices most conducive to high student performance.

Standards for Professional Learning

The references in the subsections address the seven standards for professional learning as revised by Learning Forward in 2011: Learning Communities, Leadership, Resources, Data, Learning Designs, Implementation, and Outcomes. Each subsection briefly describes the elements of each standard, the literature that represents those elements, and the literature that contributes to the shaping of each standard.

Learning Communities

Professional learning that increases educator effectiveness and results for all students occurs within learning communities committed to continuous improvement, collective responsibility, and goal alignment. The conceptual framework of the standard learning communities encompasses the following core elements: (1) engaging in continuous improvement, (2) developing collective responsibility, and (3) creating alignment and accountability. The references in the subsections were chosen because they reflect the research base for the core elements of the standard and because of the authority of the researchers.

Professional Learning Communities

This subsection includes works about learning in community; accordingly, graduate students and scholars will want to read the following research studies because they reflect the interest in school-based teacher learning and development that grew in the 1980s and 1990s.

Vescio, et al. 2008, a literature review, should interest researchers because it concludes with suggestions for further investigation into the impact of professional learning communities on teacher practice and student achievement. Louis, et al. 1995 identifies the school as the unit of change and joins the idea of continuous professional learning with that of learning communities. Likewise, Loucks-Horsley, et al. 1996 applies principles of adult learning to learning communities for teaching of mathematics and science. Using discourse of school improvement, Joyce and Calhoun 1996 describes case studies showing professional development as a capacity-building tool. Subsequent ideas about structures for school-based teacher education and development, such as professional learning communities (PLCs) and teacher learning teams (LTs), can be traced to resources that include Hawley and Valli 1999 and Hord 1997. Readers should look at Peterson, et al. 1996 and Stigler and Hiebert 1999 for further examination of the element of continuous learning. Coburn 2001, a case study, examines teachers' collective understanding as it is shaped by formal and informal alliances.

Coburn, C. E. 2001. Collective sensemaking about reading: How teachers mediate reading policy in their professional communities. *Educational Evaluation and Policy Analysis* **23.2: 145–170.**

This case study of one California elementary school examines a model of reading teachers' collective sensemaking that focuses on how teachers co-construct understandings of policy messages and negotiate implementation in conversations with colleagues. Findings also suggest that structures of formal networks and informal alliances shape the process, as leadership also does.

Hawley, W., and L. Valli. 1999. The essentials of effective professional development: A new consensus. In *Teaching as the learning profession: Handbook of policy and practice.* **Edited by L. Darling-Hammond and G. Sykes, 127–150. San Francisco: Jossey-Bass.**

The chapter describes elements that contribute to a new way of framing professional development as a continuous and collective process of professional learning. Such essentials call for rethinking how leadership is shared with teachers and how teachers accept collective responsibility for learning and instructional decision making.

Hord, S. 1997. *Professional learning communities: Communities of continuous inquiry and improvement.* **Austin, TX: Southwest Educational Development Laboratory.**

This research review articulates requirements for effective professional learning communities: supportive and shared leadership, collective creativity, shared values and vision, supportive conditions (physical and personal), shared practice, and peer support.

Joyce, B., and E. Calhoun, eds. 1996. *Learning experiences in school renewal: An exploration of five successful programs.* **Eugene, OR: ERIC Clearinghouse on Educational Management.**

This work describes five case studies focusing on components of school renewal: using staff development and action research as school improvement tools, using governance structures, using an initiative to create a culture of readers and writers, and using staff development as a capacity-building tool for inner-city schools.

Loucks-Horsley, S., K. Stiles, and P. Hewson. 1996. *Principles of effective professional development for mathematics and science education: A synthesis of standards.* **NISE Brief 1.1. Madison: National Institute for Science Education, Univ. of Wisconsin.**

This synthesis is important in research about mathematics/science professional development because it derives principles of professional development based on notions of a systemic and systematic process of professional learning that add to the literature about the use of adult-learning methods and development of teacher learning communities.

Louis, K. S., and S. Kruse, with A. Bryk, J. Hopkins, J. King, M. Lonnquist, M. Raywid, S. Rollow, and D. Weiss. 1995.

***Professionalism and community: Perspectives on reforming urban schools*. Thousand Oaks, CA: Corwin.**

Five longitudinal case studies demonstrate structural and social/human resource conditions that affect the creation of professional community. While an absence of structure impedes growth, the presence of supportive structures is insufficient to sustain growth. Teacher autonomy is necessary but insufficient to create community; time and physical proximity are of equal or greater importance.

Peterson, P., S. McCarthey, and R. Elmore. 1996. Learning from school restructuring. *American Educational Research Journal* 33.1: 119–153.

This research article reports on an analysis of three elementary school restructuring experiments that suggest teaching and learning is a function of teachers' beliefs and behaviors about specific classroom problems and that changing classroom practice is more an issue of continuous learning than one of school organization.

Stigler, J., and J. Hiebert. 1999. *The teaching gap: Best ideas from the world's teachers for improving education in the classroom*. New York: Free Press.

This book analyzes the Third International Mathematics and Science Study results to show limitations of American teaching methods. Authors propose a plan for improving classroom teaching: expect continual improvement; focus on student learning goals; focus on teaching, not teachers; improve context; improve teachers' practice; and build an open, adaptive system.

Vescio, V., D. Ross, and A. Adams. 2008. A review of research on the impact of professional learning communities on teaching practice and student learning. *Teaching and Teacher Education* 24:80–91.

Review of eleven empirical studies suggests that participation in learning communities affects teaching practice and student learning, as indicated by improved achievement scores over time. Saying that further research is imperative, the authors conclude that such research must draw broadly across various methodologies and include analysis of student achievement data.

Teachers' Learning Communities

By the close of the first decade of the 21st century, researchers had refined the operational definitions of professional learning communities (PLCs) among the many different forms and to test the links among the features of a PLC, teacher practice, and student learning. The resources in this section were chosen because of the scope of their efforts to establish or refine a research framework (e.g., Lieberman and Miller 2008, McLaughlin and Talbert 2006), define PLCs (e.g., Bolam, et al. 2005, a large multi-method research project; McLaughlin and Talbert 2006), and test the features of PLCs using rigorous research techniques and the most recent databases available to researchers. Students and scholars will want to read the large, quasi-experimental studies that build on the notion that an important type of teacher learning occurs in classrooms and school with colleagues and that begin to frame collective learning and the responsibility and accountability of PLCs in Gallimore, et al. 2009. Likewise, school leaders and principal supervisors will want to read another article drawn from the same study of Title I schools, Saunders, et al. 2009, which shows that teachers' collective, facilitated focus on instruction resulted in student gains. And while Gallimore, et al. 2009 and Saunders, et al. 2009 both provide initial evidence that specific teacher collaboration is associated with student achievement, neither study addresses the common types of collaboration that occur among teachers, nor do they examine whether such collaboration improves student achievement. Ronfeldt, et al. 2015 extends this literature to examine collaboration as a within-school phenomenon rather than a school–wide phenomenon, and as one with variability within and among schools. Administrators who facilitate the conditions of teacher and learning also should read Supovitz 2002, McLaughlin and Talbert 2006, and Weiss and Pasley 2006. Supovitz 2002 raises interesting questions about the limitations of the impact of PLCs on student learning without the mediating effects of workplace conditions that support ongoing inquiries into teaching and learning or collective problem solving. Two studies that focus on subject matter are congruent with the finding in Supovitz 2002 that workplace conditions must be created explicitly to support communities' for teaching to be effective. Contrasting various case studies across K–12 classrooms in literacy and mathematics, McLaughlin and Talbert 2006 concludes that learning community development and sustenance depend on a joint focus on a single aspect of instruction, the creation of an effective learning environment for teachers, and proactive administrator support and teacher leadership. And Weiss and Pasley 2006 finds that

sufficient time and focus on instruction had positive outcomes for mathematics and science teachers.

Bolam, R., A. McMahon, L. Stoll, S. Thomas, and M. Wallace. 2005. *Creating and sustaining professional learning communities*. London: General Teaching Council for England.

This report of a multi-method research project encompasses a literature review and framework, survey of 1,300 schools, sixteen case studies, and workshops to verify case study findings. When the study of thirty-four months began, PLCs were new structures in UK schools. Now, they figure in national plans for raising standards in teaching and learning.

Gallimore, R., B. A. Ermeling, W. M. Saunders, and C. Goldenberg. 2009. Moving the learning of teaching closer to practice: Teacher education implications of school-based inquiry teams. *Elementary School Journal* 109.5: 537–553.

Discusses a five-year quasi-experimental investigation showing how teacher teams in nine Title I schools used inquiry-based protocols to see causal relationships between instruction and learning, solve instructional problems, and significantly increase student achievement. Authors posit such outcomes are more likely with facilitated peer learning in stable, school-based settings.

Lieberman, A., and L. Miller, eds. 2008. *Teachers in professional communities: Improving teaching and learning*. New York: Teachers College, Columbia Univ.

In this compilation, editors offer a research-based framework through which to consider the literature and practices of teachers' professional communities. Contributing practitioners draw on their experiences to show how teachers and students benefit from new expectations and practices developed by members of professional communities.

McLaughlin, M., and J. Talbert. 2006. *Building school-based teacher learning communities: Professional strategies to improve student achievement*. New York: Teachers College Press.

Authors analyze research to suggest positive relationships among professional community, teaching practice, and student achievement. Drawing on decades of research, they describe supports needed to build and sustain a school-based teacher professional community: joint work on one facet of instruction, effective guidance of that work, administrator support, and teacher leadership.

Ronfeldt, M., S. Farmer, K. McQueen, and J. Grissom. 2015. Teacher collaboration in instructional teams and student achievement. *American Educational Research Journal* 52.3: 475–514.

This study examines data from over nine thousand teachers in Miami-Dade public schools to identify types of collaboration among teacher teams across the district. Researchers created multiple models to strengthen the potential for making causal inferences about the positive effects of high-quality teacher collaboration on teacher performance and student achievement.

Saunders, W. M., C. N. Goldenberg, and R. Gallimore. 2009. Classroom learning: A prospective, quasi-experimental study of Title I schools. *American Educational Research Journal* 46.4: 1006–1033.

Longitudinal study in a large district examines effects of facilitated, grade-level PLCs on student learning. Teachers and principals in the intervention group conducted multiple grade-level meetings each month focused on specific curriculum/instruction. Student test scores of teachers in the intervention group showed gains over those of the control group.

Supovitz, J. A. 2002. Developing communities of instructional practice. *Teachers College Record* 104.8: 1591–1626.

This article reports on a four-year evaluation of a team-based schooling initiative in a medium-sized urban district. Results suggest that,

although organizational reforms may improve the teaching culture, they are unlikely to improve instruction and student learning without ongoing professional learning that supports inquiries into teaching and learning.

Weiss, I. R., and J. D. Pasley. 2006. *Scaling up instructional improvement through teacher professional development: Insights from the local systemic change initiative.* **Philadelphia: Consortium for Policy Research in Education (CPRE) Policy Briefs.**

The authors analyze results from the Local Systemic Change Initiative (LSC) and conclude that mathematics and science professional development can be implemented effectively at scale. Typically, about thirty to eighty hours of professional development focused on instructional content, supported and sustained over time, showed positive impact on teachers and teaching.

Leadership

Professional learning that increases educator effectiveness and results for all students requires skillful leaders who develop capacity and who advocate and create support systems for professional learning. The conceptual framework of the leadership standard encompasses the following core elements: (1) developing capacity for learning and leading, (2) advocating for professional learning, and (3) creating supporting systems and structures. The references were chosen in these subsections because they reflect the research base for the core elements of the standard and because of the authority of the researchers. Accordingly, some of these research studies overlap between one or more core elements: developing capacity, advocating, and creating supporting systems and structures.

Developing Capacity for Learning and Leading

Professional development leaders, school leaders, and teacher leaders will want to consider Coburn 2001 and Elliott, et al. 2009 because of the discussions in these works of the types of knowledge leaders must have to develop their own and faculty capacities to learn together effectively. Both resources discuss how leaders must have an understanding of the specialized content, in these cases reading and mathematics, respectively, as well as knowledge of teacher learning and facilitation. They will also want to read the extensive reviews of leadership literature in Knapp, et al. 2003 and York-Barr and Duke 2004, the latter particularly for its discussion of teacher leaders. And to delve more deeply into the concept of distributed leadership, which is a more complex capacity than simply sharing leadership, professional development leaders must read both Spillane, et al. 2001 and Timperley 2008. Spillane, et al. 2001 is a longitudinal study that examines the distribution of leadership among Chicago schools. Timperley 2008 draws on Spillane, et al. 2001 to discuss case studies that demonstrate how sites build the capacity of distributed leadership. Boylan 2016 extends the literature of distributed leadership to the head-teacher structure in the United Kingdom. He proposes that education decision-makers recognize teacher leaders as having the means and agency to influence system-wide change.

Boylan, M. 2016. Deepening system leadership: Teachers leading from below. *Educational Management Administration Leadership* **44.1: 57–72.**

This article redefines system leadership around dimensions of interschool collaboration, leadership identity, and system-wide leadership to argue that classroom teacher leaders contribute in each of those realms. Such redefinition informs the future development of research tools needed to examine systemic effects of the collective activity of teacher leaders.

Coburn, C. E. 2001. Shaping teacher sensemaking: School leaders and the enactment of reading policy. *Educational Policy* **19.3: 476–509.**

This case study of two California elementary schools examines how principals influence teacher learning about, and implementation of, reading policy. The principals drew on their understandings of reading instruction and teacher learning to shape teachers' access to policy ideas, interpret policies, and create substantively different conditions for professional learning.

Elliott, R., E. Kazemi, K. Lesseig, J. Mumme, C. Carroll, and M. Kelley-Petersen. 2009. Conceptualizing the work of leading mathematical tasks in professional development. *Journal of Teacher Education* **60:364–379.**

The authors posit that professional development (PD) leaders must understand three frameworks to advance their skills for facilitating mathematics-focused PD: socio-mathematical norms, specialized content knowledge (SCK), and practices for teacher sharing. Drawing from the three frameworks provides leaders a means for orchestrating productive discussions and deliberately pursuing SCK-oriented goals.

Knapp, M. S., M. A. Copland, and J. E. Talbert. 2003. *Leading for learning: Reflective tools for school and district leaders.* **Seattle, WA: Center for the Study of Teaching and Policy.**

This report synthesizes research literature, examples of leadership in action from published case studies, and educators' professional knowledge to offer a framework of reflective ideas and tools for action in five areas: establishing a focus on learning, building professional communities, engaging external environments, acting strategically, and creating coherence.

Spillane, J. P., R. Halverson, and J. B. Diamond. 2001. Investigating school leadership practice: A distributed perspective. *Educational Researcher* **30.3: 23–27.**

This study presents an analytic framework that guided the authors' five-year investigation of the practice of school leadership in Chicago-area elementary schools. From a distributed perspective, leadership practice takes shape in the interactions of people and their situation. How leadership is distributed, especially for instruction, becomes an essential responsibility.

Timperley, H. S. 2008. A distributed perspective on leadership and enhancing valued outcomes for students. *Journal of Curriculum Studies* **40.6: 821–833.**

This essay reviews two works by Spillane and Diamond and discusses distributed leadership as a tool for analysis of leadership rather than a prescription for how to share it. From both books, Timperley explicates case studies to describe structures, routines, and artifacts of distributed leadership frameworks. Suggests future research agenda.

York-Barr, J., and K. Duke. 2004. What do we know about teacher leadership? Findings from two decades of scholarship. *Review of Educational Research* **74.3: 255–316.**

Review of research on teacher leadership addresses both scholarly and practice-oriented needs around the following questions: (1) What do teacher leaders do? (2) Who are teacher leaders? (3) What conditions influence teacher leadership? Gives a framework and findings of multiple research studies on teacher leadership.

Advocating for and Creating Structures for Professional Learning

The creation of conditions that support professional learning is about the culture of the learning environment, and several reviews and studies identify those associated with effective professional learning. Many of the resources in this subsection reflect a theme about the influence of cultures—from communities of interest to classroom to national cultures—in the creation and support of leadership for professional learning. The first such study is Little 1982, an ethnography of the school as a workplace that supports continuous teacher learning through collaborative problem solving, which, when supported correctly, results in the development of shared language and understanding of good practice. Hargreaves, et al. 2007 focuses on how a broader national cultural context promotes conditions of distributed leadership at local school sites. Students and scholars will want to read two resources that report on empirical research studies of leadership: Pechman and King 1993 is a study of implementation in middle-grade schools, which found that teacher leadership was a feature that contributed to successful reform implementation, and Leithwood, et al. 2004 includes empirical research in a comprehensive review linking leadership practices with student learning. In their meta-analysis, the contributors in Waters, et al.

2003 also point out strong relationships between leadership responsibilities and student achievement; moreover, leadership can have positive and marginal, or worse, negative impacts on student achievement. Jacob, et al. 2015 uses a randomized design to assess the impact of the program Waters, et al. 2003 describes. Jacob and colleagues found no impact on student achievement in participating schools after three years. They found some positive effect on principal and teacher turnover in participating schools after three years and conflicting reports from teachers and principals. Authors discuss possible reasons and suggest further research.

Hargreaves, A., G. Halász, and B. Pont. 2007. *School leadership for systemic improvement in Finland: A case study for the OECD activity improving school leadership***. EDU/EDPC(2008)8. Paris: Directorate for Education, Organisation for Economic Co-operation and Development.**

This case study, part of an OECD study, describes how Finland has successfully managed to distribute school leadership. Finland's approach models systemic leadership cooperation focused on student outcomes. Authors suggest, however, that the model cannot be copied wholesale because it is endemic to Finnish culture and the value of lifelong learning.

Jacob, R., R. Goddard, M. Kim, R. Miller, and Y. Goddard. 2015. Exploring the causal impact of the McREL balanced leadership program on leadership, principal efficacy, instructional climate, educator turnover, and student achievement. *Educational Evaluation and Policy Analysis* **37.3: 314–332.**

Study examines effects of the Balanced Leadership program on principal leadership/efficacy, instructional climate, staff turnover, and student achievement. Participating schools experienced more positive effects on principal leadership/efficacy and staff turnover than control groups. Teachers reported no change in instructional climate, and researchers found no impact on student achievement.

Leithwood, K., K. Seashore-Louis, S. Anderson, and K. Wahlstrom. 2004. *How leadership influences student learning: A review of research for the learning from leadership project***. New York: Wallace Foundation.**

Review includes two types of evidence: original empirical research conducted in the last decade using a variety of methods and comprehensive reviews of research published in peer-reviewed sources. Describes leadership literature and core practices, distribution, and roots of leadership practice and links successful leadership practices with student learning.

Little, J. 1982. Norms of collegiality and experimentation: Workplace conditions of school success. *American Educational Research Journal* **19.3: 325–340.**

In this early empirical work, Little interviewed 105 teachers and fourteen administrators and adds supplemental analyses with observations to create a case study of six schools. The result is an ethnography of the school as a workplace, specifically of those organizational characteristics conducive to teachers' continued "learning on the job."

Pechman, E., and J. King. 1993. *Obstacles to restructuring: Experiences of six middle-grades schools***. New York: National Center for Restructuring Education, Schools and Teaching.**

Authors examine implementation of an improvement effort in six middle-grade schools. Researchers identified six factors needed for successful school reform: a stable, safe environment; ongoing district-level support; teacher leaders within the school; collaboration among the entire staff; faculty commitment to the change process; and a facilitative principal who encourages collegiality.

Waters, J. T., R. J. Marzano, and B. A. McNulty. 2003. *Balanced leadership: What 30 years of research tells us about the effect of leadership on student achievement***. Aurora, CO: Mid-Continent Research for Education and Learning.**

Meta-analysis examines seventy (from 5,000) studies meeting criteria for design, controls, data analysis, and rigor. Selected studies involve 2,984 schools, 1.1 million students, and 14,000 teachers. Authors identified twenty-one leadership responsibilities and found

that leaders can have a positive as well as a marginal, or negative, impact on achievement.

Resources

Professional learning that increases educator effectiveness and results for all students requires prioritizing, monitoring, and coordinating resources for educator learning. The conceptual framework of the resources standard encompasses the following core elements: (1) prioritizing human, fiscal, material, technology, and time resources; (2) monitoring resources; and (3) coordinating resources. The references were chosen for all three subsections because they reflect the research base for the core elements of the standard, demonstrate rigor in the topic area and relevance in application of resources to professional development, and also because of the authority of the researchers.

Prioritizing

Because the mobilization of resources determines the design and provision of professional development, administrators and professional development facilitators will want to read Abdal-Haqq 1996, a monograph on time and professional development, for its historical value as well as its application to the prioritization of use of time and patterns of scheduling to provide for professional development that is long-term and allows for collective learning and problem solving. Haslam 1997 also discusses the relevance of time to the design of collaborative and reflective professional development as the author proposes six strategies that touch rather broadly on the three core elements. Knapp 2003 considers resources more generally in discussing the policy tools that leaders can use to create conditions that allow for the prioritization of resources in the first place. Students, scholars, and administrators will appreciate the contribution of Odden, et al. 2002 to the standardization of the research field in constructing a cost framework based on the elements of professional development. As the contributors in Odden, et al. 2002 would wish, the framework is applied in the exploratory study in Chambers, et al. 2008. Miles and Frank 2008 applies another framework organized around resources of people, time, and money to show how leaders who choose priorities among those resources can reverse effects in struggling schools.

Abdal-Haqq, I. 1996. *Making time for teacher professional development.* **ED400259. Washington, DC: ERIC Clearinghouse on Teaching and Teacher Education.**

This paper examines research and best practice about effective professional development—specifically, the implications of traditional school scheduling patterns for implementing effective professional development. The author describes approaches of various schools and districts to find time for teacher development activities.

Chambers, J. G., I. Lam, and K. Mahitivanichcha. 2008. *Examining context and challenges in measuring investment in professional development: A case study of six school districts in the southwest region.* **Issues & Answers Report REL2008-No. 037. Washington, DC: Institute of Education Sciences.**

Applies the conceptual framework created in Odden, et al. 2002 to measure professional development investments in six school districts. Authors estimate that 2–9 percent of the district budget was allocated to professional development, probably an underestimate. They document challenges of collecting accurate data due to job-embedded professional development.

Haslam, M. B. 1997. How to rebuild a local professional development infrastructure: Getting better by design. Arlington, VA: New American Schools.

This report argues that many schools still treat professional development as something "delivered" to teachers with no follow-up opportunities, little or no time for individual or collective reflection, and little testing of new ideas and information. Instead, Haslam outlines a six-step school transformation strategy for district professional development.

Knapp, M. S. 2003. Professional development as a policy pathway. *Review of Research in Education* **27:109–157.**

Knapp reviews several bodies of literature to describe how state and district policymakers use policy instruments and tools to improve professional and student learning. From case studies, he synthesizes district and state strategies, including creating professional learning environments, building support for administrator and teacher learning, and developing professional learning infrastructure.

Miles, K. H., and S. Frank. 2008. *The strategic school: Making the most of people, time, and money.* **Thousand Oaks, CA: Corwin.**

Authors draw on their research to present case studies of schools that reorganized priorities of resources around the "Big 3 Guiding Resource Strategies": improving teaching quality, creating individual attention, and maximizing academic time. Includes checklists, planning guides, and worksheets.

Odden, A., S. Archibald, M. Fermanich, and H. A. Gallagher. 2002. A cost framework for professional development. *Journal of Education Finance* **28.1: 51–74.**

Odden and colleagues establish a common framework for assessing costs of professional development programs: teacher time; training and coaching; administration; materials, equipment, and facilities; travel and transportation; and tuition and conference fees. The framework standardizes a meaningful level of detail to advance professional development research and practice.

Monitoring and Coordinating

Practitioners will be interested in three research studies—Organisation for Economic Co-operation and Development 2010; Perez, et al. 2007; and Plecki, et al. 2009— that analyze data collected from selected education systems to understand the impacts of resource allocation, including time and human resources, on the creation of collaborative teaching cultures. Cobb and McClain 1996 and Hawley 2006 show additional school-based cases in which allocating, monitoring, and coordinating multiple resource streams had a positive effect on professional learning and continuous improvement.

Cobb, P., and K. McClain. 1996. The collective mediation of a high stakes accountability program: Communities and networks of practice. *Mind, Culture, and Activity* **13:80–100.**

Article describing how district and school leaders mediated high-stakes accountability policies in support of middle-school mathematics teachers. In this case, leaders responded to a state-mandated accountability program by giving teachers access to material resources and by supporting their development of social and personal resources rather than regulating instructional practices.

Hawley, W. D., ed. 2006. *The keys to effective schooling: Educational reform as continuous improvement.* **Thousand Oaks, CA: Corwin.**

This handbook offers lessons from research for changing school cultures to improve teaching and learning. Leaders in the field contribute chapters that address issues ranging from teachers' collective learning to the development of teacher leadership to the allocation of resources at the school level.

Organisation for Economic Co-operation and Development. 2010. *Strong performers and successful reformers in education: Lessons from PISA for the United States.* **Paris: Organisation for Economic Co-operation and Development.**

This report compares detailed analyses of education policies and practices in systems that are close to the "top or advancing rapidly." Lessons include developing more capacity at the point of delivery, providing a workplace in which teachers realize their potential,

institutionalizing improved instructional practice, aligning incentive structures, and engaging stakeholders.

Perez, M., P. Anand, C. Speroni, et al. 2007. *Successful California schools in the context of educational adequacy.* **Washington, DC: American Institutes for Research.**

This study analyzes practices in schools that "beat the odds," thus performing at higher levels than predicted by their demographics. Authors examined resource use and factors related to student success. Results suggest these schools had neither more nor less resources than control schools but administrators tended to have more experience.

Plecki, M. L., M. S. Knapp, T. Casteneda, T. Halverson, R. LaSota, and C. Lochmiller. 2009. *How leaders invest staffing resources for learning improvement.* **Seattle, WA: Center for the Study of Teaching and Policy.**

Part of a large-scale study of urban school leadership, this report focuses on a two-year investigation of how leaders invested staffing resources in four urban districts and fourteen schools to ensure greater equity in learning improvement. Includes analyses of mixed-method strategy, descriptive statistics, and references.

Data

Professional learning that increases educator effectiveness and results for all students uses a variety of sources and types of student, educator, and system data to plan, assess, and evaluate professional learning. The conceptual framework of the data standard encompasses the following core elements: (1) analyzing student, educator, and system data; (2) assessing progress; and (3) evaluating professional learning. The references were chosen in this section because they reflect the research base for the core elements of the standard and because of the authority of the researchers. Practitioners and administrators will want to read Datnow 1999 and Marsh, et al. 2015 because they focus less on actual data collection and analysis and more on the context of organizational decision making and under what conditions school staffs acquire and use information to inform their choices of reform models. Turning to issues surrounding the core element of data collection and analysis, administrators will want to look at Killion 2008, a guidebook in which the author addresses the third core element: evaluation of professional development. For guidance and application in analyzing student and system data, practitioners will want to read five resources, namely Desimone 2009; Desimone, et al. 2002; Griffith, et al. 2010; Johnson 2002; and Torgesen, et al. 2006. Desimone, et al. 2002 analyzes data from the nationwide Eisenhower study to identify district strategies to affect professional development, including continuous improvement, that requires the use of needs assessment and evaluation data to measure, assess, and make choices for professional development. Griffith, et al. 2010 and Torgesen, et al. 2006 discuss the use of student data for progress monitoring and to identify teacher needs for professional development as well as technical issues such as data quality. Griffith, et al. 2010 develops a process of monitoring student progress that includes regular assessments at regular intervals in which progress reports were returned to coaches who reviewed results with teachers. Griffith, et al. 2010 reports that the "addition of progress-monitoring data has enabled the coaches to sharpen the entire process—preconference, coaching intervention, and reflection—so that the focus is specific to children's needs" (p. 48). Likewise, Reeves 2010 recalls the theme of continuous improvement as it encourages educators to use formative assessment data, or "assessment for learning," to inform teacher professional development.

Datnow, A. 1999. *How schools choose externally developed reform designs.* **Report No. 35. Baltimore: Johns Hopkins Univ.**

This qualitative study analyzes organizational decision making among schools in a large district during the 1990s. School staffs seldom made well-informed restructuring design choices, even when information was available. Instead, reform choices were characterized by bounded rationality and governed by normative factors and power relations rather than functional calculations.

Desimone, L. M. 2009. Improving impact studies of teachers' professional development: Toward better conceptualization and measures. *Educational Researcher* **38.3: 181–199.**

This paper offers recommendations on how to apply research knowledge to the conceptualization and creation of measures and methodology for examining the effects of professional development on teachers and students. Desimone recommends that the use of a common conceptual framework will strengthen evaluations of professional development.

Desimone, L. M., A. C. Porter, M. S. Garet, K. S. Yoon, and B. F. Birman. 2002. Effects of professional development on teachers' instruction: Results from a three-year longitudinal study. *Educational Evaluation and Policy Analysis* **24.2: 81–112.**

This article discusses findings from a national probability sample of district professional development coordinators. Specifically, it examines district strategies for alignment of professional development with standards, coordination among many PD activities, and continuous improvement, which draws on indicators, needs assessments, and evaluation data.

Griffith, P. L., S. J. Kimmel, and B. P. Biscoe. 2010. Teacher professional development: Closing the achievement gap by closing the instruction gap. *Action in Teacher Education* **31.4: 41–53.**

This article describes the research base and empirical evidence of a model of professional development that emerged from Early Learning First–supported action research. A core component of the model is frequent, regular progress monitoring. Literacy coaches report on and review the data with teachers to assist them in choosing professional development based on pupils' learning needs.

Johnson, R. 2002. *Using data to close the achievement gap: How to measure equity in our schools.* **Thousand Oaks, CA: Corwin.**

This book identifies six purposes for data: (1) improving quality of criteria used in problem solving and decision making; (2) describing institutional processes, practices, and progress in schools and districts; (3) examining institutional belief systems underlying assumptions and behaviors; (4) mobilizing the school community; (5) monitoring implementation; and (6) accountability.

Killion, J. 2008. *Assessing impact: Evaluating staff development.* **2d ed. Thousand Oaks, CA: Corwin.**

This book, designed for professional development program leaders, begins with the premise that when staff development is carefully planned, the integrity and "evaluability" of the program will be stronger. It includes an eight-step process for planning and evaluating a staff development program and tools to help design an evaluation plan.

Marsh, J., M. Bertrand, and A. Huguet. 2015. Using data to alter instructional practice: The mediating role of coaches and professional learning communities. *Teachers College Record* **117.4: 1–40.**

A year-long comparative case study of six low-performing middle schools in four districts that supported teacher data use via literacy coaches, data coaches, or PLCs. Authors found that coaches and professional learning communities within supportive contexts influenced how teachers responded to and used data to change instruction.

Reeves, D. B. 2010. *Transforming professional development into student results.* **Alexandria, VA: Association of Supervision and Curriculum Development.**

This monograph draws on a three-year investigation of relationships between how well school staffs plan, implement, and monitor improvements and how well their students perform in reading and mathematics. Reeves shows school staffs how to focus on and provide effective professional learning and use "assessment for learning" for the long term.

Torgesen, J., J. G. Meadows, and P. Howard. 2006. *Using student outcome data to help guide professional development and teacher support: Issues for reading first and K-12 reading plans.* **Tallahassee: Florida Center for Reading Research.**

This paper affirms the use of student data to identify teacher professional development needs and provide additional support in teaching low-achieving students. Authors describe uses of student data to focus teacher development and support, raise issues of data quality, and consider other learning/support practices (e.g., coaching, common planning time).

Learning Designs

Professional learning that builds educator effectiveness and results for all students integrates theories, research, and models of human learning to achieve its intended outcomes. The conceptual framework of the standard of learning designs encompasses the following core elements: (1) applying learning theories, research, and models; (2) selecting learning designs; and (3) promoting active engagement. The references were chosen in the following subsections because they reflect the research base for the core elements of the standard and because of the authority of the researchers.

Applying Theory and Research

Graduate students will want to read several foundational studies for their contributions to the literature that addresses the first core element—applying learning research, theories, and models to the core features of effective professional learning—beginning with Sparks and Loucks-Horsley 1989, which includes descriptions of five learning models, and following with Gall and Vojtek 1994, which classifies six models. Remillard 2005 proposes a framework for a new way of considering the relationships among the constructs of teacher curriculum use, teaching, and curriculum materials for findings that will inform professional development researchers and designers. Readers will find that Kazemi and Hubbard 2008 forms another bridge between applying research models and selecting learning designs. In calling for researchers to develop and test different representations of teacher learning, Kazemi and Hubbard 2008 describes an agenda with the potential for clarifying theory and diversifying learning designs. A fourth book that may be of particular interest to researchers and professional development practitioners is Joyce and Calhoun 2010, which reviews professional development literature to compile five models of professional development. While they describe the contexts in which the models were, and may be, applied, the authors also raise issues about the complexity involved in conducting evaluation and research on professional development.

Gall, M., and R. Vojtek. 1994. *Planning for effective staff development: Six research-based models.* **Eugene, OR: ERIC Clearinghouse on Educational Management.**

This monograph develops a classification of teacher staff development objectives based on eight categories. From those, authors identify six models for staff development as well as program features that should be incorporated in the design of teacher staff development approaches.

Joyce, B., and E. Calhoun. 2010. *Models of professional development: A celebration of educators.* **Thousand Oaks, CA: Corwin.**

Authors survey professional development literature to describe five models of professional development: individual support, personal/professional service, social construction of knowledge and action, curricular/instructional initiatives, and short-term workshops. In each chapter they elaborate on a model, discussing complexities and interrelationships across systems as well as organizational characteristics required for implementation.

Kazemi, E., and A. Hubbard. 2008. New directions for the design and study of professional development: Attending to the coevolution of teachers' participation across contexts. *Journal of Teacher Education* **59:428–441.**

Authors argue that researchers should reconsider the unidirectional relationship between PD and teacher practice. Rather, teachers' ways of knowing coevolve between their actions in PD and in the classroom. Researchers and developers should investigate multiple representations of practice—artifacts, depictions, enactments—to deepen understanding about how teachers use them to generate knowledge.

Remillard, J. T. 2005. Examining key concepts in research on teachers' use of mathematics curricula. *Review of Educational Research* **75:211–246.**

This review examines conceptualizations of constructs—teacher curriculum use (following, interpreting, or subverting text), teaching (multidimensional engagement with curriculum), and curriculum materials (degree of participation)—and how such conceptualizations affect knowledge in the field. Drawing on the literature, Remillard offers a framework for characterizing and studying teachers' interactions with mathematics curriculum materials.

Sparks, D., and S. Loucks-Horsley. 1989. Five models of staff development for teachers. *Journal of Staff Development* **10.4: 40–57.**

This article describes five models for developing teachers: individually guided, observation/assessment, involvement in a development/improvement process, training, and inquiry (individual or group). The authors provide examples, explain the theoretical and research underpinnings and potential outcomes of each model, and describe the organizational contexts needed to support each model.

Selecting Learning Designs

For addressing the second core element, selecting learning designs, graduate students and practitioners will be interested in three research studies that identify the core features of professional development that inform choices of designs to meet specific professional development goals. One of the most noteworthy studies of professional development effectiveness is Garet, et al. 2001, the nationwide Eisenhower study that uses regression modeling to examine how core and structural components (i.e., form, duration, collective participation, content, active learning, and coherence) impact professional development. Garet, et al. 2001 identifies three essential features of professional development activities that have the strongest associations with increased teacher knowledge, namely a focus on content knowledge, opportunity for active learning, and coherence with other learning activities. Although previous research literature had identified many of the features found to be significant predictors of effectiveness in the Eisenhower study, the study is important because it expands the empirical evidence of the relative value of specific professional development features. Penuel, et al. 2007 confirms the findings in Garet, et al. 2001, including the significance of teachers' perceptions about coherence of their professional development experiences for learning. Croft, et al. 2010 defines job-embedded professional development and demonstrates a continuum of such activities. The authors discuss how practitioners and administrators might select, implement, and assess different configurations of job-embedded professional development activities. Fishman, et al. 2013 considers the how technology changes learning design with a comparison of blended and online professional development on teacher and student effects. Professional development providers and coaches will want to read Easton 2015 to review a broad range of designs they can choose from.

Croft, A., J. G. Coggshall, M. Dolan, E. Powers, and J. Killion. 2010. *Job-embedded professional development: What it is, who's responsible, and how to get it done well.* **Washington, DC: National Comprehensive Center for Teacher Quality.**

This briefing paper defines job-embedded professional development. Using an Innovation Configuration chart, the authors show the range of learning opportunities from those who are largely situated in classrooms and schools to those outside the immediate work setting. The authors also describe job-embedded professional development formats and related research findings.

Easton, L. B., ed. 2015. *Powerful designs for professional learning***. 3d ed. Oxford, OH: Learning Forward.**

This third edition is a compilation of research and practice related to twenty-four designs for adult learning. Includes articles about fifteen new learning designs and updated versions of other articles.

Fishman, B., S. Konstantopoulous, B. Kubitskey, R. Vath, G. Park, and D. Edelson. 2013. Comparing the impact of online and face-to-face professional development in the context of curriculum implementation. *Journal of Teacher Education* **64.5: 426–438.**

This study examines two professional development modalities: (1) face to face in a summer workshop, and (2) blended online, which included two days of face-to-face orientation and subsequent online learning during a course of several months. Analyses of teacher factors and student learning showed no significant difference between the two designs.

Garet, M. S., A. Porter, L. Desimone, B. Birman, and K. S. Yoon. 2001. What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal* **38.4: 915–945.**

Discusses an empirical study that used a national probability sample of 1,027 mathematics/science teachers to compare effects of professional development characteristics on teachers' learning. Three core features had significant, positive effects on teachers' increased knowledge: focus on content knowledge, opportunity for active learning, and coherence with other learning activities.

Penuel, W. R., B. J. Fishman, R. Yamaguchi, and L. P. Gallagher. 2007. What makes professional development effective? Strategies that foster curriculum implementation. *American Educational Research Journal* **44.4: 921–958.**

This article discusses a study of 454 teachers that confirms findings of the Eisenhower study, including the significance of teachers' perceptions about coherence of their professional development experiences for learning. Authors also found that incorporation of planning time and provision of technical support were significant for promoting program implementation.

Promoting Active Engagement

Finally, bridging between selecting learning design and the third core element, promoting active engagement, Joyce and Showers 2002 contains the results of long-term research efforts to suggest that teachers need time and opportunities to investigate why some practices might be better than others, see models of such practices, and personally develop these practices. School- and district-level supports are essential components to the engagement of teachers in learning and applying new practices. Brooks and Brooks 1993 examines the teaching-learning dynamic to apply the theory of constructivism to the engagement of students in learning experiences and how doing so affects the teacher's role in such learning experiences. Finally, Dede 2006 describes different models of teacher and student online engagement based on a series of case studies the authors conducted in 2005, and Borko, et al. 2009 discusses the uses of video technologies to help members of teacher communities gather evidence and practice analytical discussion focused on those video artifacts of behavior and interactions.

Borko, H., J. Jacobs, E. Eiteljorg, and M. E. Pittman. 2009. Video as a tool for fostering productive discussions in mathematics professional development. *Teaching and Teacher Education* **24:417–436.**

Recounting difficulties in measuring professional development effectiveness, the authors examine use of classroom video to foster productive discussions within teacher communities. They discuss a professional development program, a problem-solving cycle model that focuses on the use of video, efforts to promote a supportive and analytical community, and development of teachers' conversations about video.

Brooks, J., and M. Brooks. 1993. *In search of understanding: The case for constructivist classrooms.* **Alexandria, VA: Association of Supervision and Curriculum Development.**

This monograph describes five principles for teaching derived from constructivism: (1) posing problems of emerging relevance, (2) structuring learning around "big ideas" or primary concepts, (3) integrating students' points of view, (4) adapting curriculum to address students' suppositions, and (5) assessing student learning relative to teaching.

Dede, C., ed. 2006. *Online professional development for teachers: Emerging models and methods.* **Cambridge, MA: Harvard Education.**

This compilation synthesizes empirical research studies of online teacher development projects to derive a framework, which is applied to an analysis of case studies of ten exemplary online professional development programs. The editor proposes further investigation of engagement in online programs, participant evaluation, and scaling up of small programs.

Joyce, B., and B. Showers. 2002. *Student achievement through staff development.* **3d ed. Alexandria, VA: Association of Supervision and Curriculum Development.**

This monograph offers a rationale for staff development based on the goal of student learning. The authors review nearly twenty-five years of research in staff development practices; they propound an investment of adequate time and money to support long-term effective educator professional learning.

Implementation

Professional learning that increases educator effectiveness and results for all students applies research on change and sustains support for implementation of professional learning for long-term change. The conceptual framework of the implementation standard encompasses the following core elements: (1) applying change research, (2) sustaining implementation, and (3) providing constructive feedback. The references were chosen in this section because they reflect the research base for the core elements of the standard and because of the authority of the researchers.

Applying Change Research

Students, decision makers, and educators will appreciate that four of the resources in this section are written by researchers who contributed foundational pieces to the research literature on change, including Bandura 1986, which constitutes an expansion of the author's social cognitive theory, Fullan 2007, Hall and Hord 2014, and Huberman and Miles 1984. Hall and Hord 2014 and Huberman and Miles 1984 also describe processes for sustaining and measuring the implementation of an innovation, the second and third core elements of this standard.

Bandura, A. 1986. *Social foundations of thought and action: A social cognitive theory.* **Englewood Cliffs, NJ: Prentice Hall.**

Bandura refines his social *learning* theory into one that constitutes a *cognitive* theory, and he attributes significant roles to cognitive, vicarious, self-, and self-reflective processes in human adaptation and change. This book emphasizes "reciprocal causation" through the interaction of behavioral, cognitive, and environmental factors, which has implications for changing the conditions of teaching and learning in schools.

Fullan, M. 2007. *The new meaning of educational change.* **4th ed. New York: Teachers College, Columbia Univ.**

This review of thirty years of planned educational change enlightens the processes of bringing about change in elementary and secondary schools. Fullan compiles the best lessons from theory and practice to explain why change processes work as they do and to

identify what could be done to improve them.

Hall, G. E., and S. M. Hord. 2014. *Implementing change: Patterns, principles and potholes.* 4th ed. Upper Saddle River, NJ: Pearson.

Textbook examines the concerns-based adoption model in four sections: the context for implementing change, tools and techniques for change facilitators (includes stages of concern, levels of use, and innovation configurations), the imperative for leadership in change, and constructing and understanding the realities of change, namely organizational culture, climate, and context.

Huberman, M., and M. B. Miles. 1984. *Innovation up close: How school improvement works.* New York: Plenum.

This book examines a nationwide study concerning dissemination and school improvement. Using ethnographic methods, the authors create a subset of twelve cases to examine the effects of context, innovation, and assistance on a change process proceeding from adoption to transformations and resulting in usage stabilization, student impacts, and personnel job mobility.

Sustaining Implementation and Providing Feedback

Starkey, et al. 2009 points out that educational reform movements across the globe reflect high student expectations, and such expectations require that teachers change classroom practice. Policymakers and decision makers, particularly those at state and local levels, will be interested in the references in this subsection because they are important resources for those who must apply research findings to the refinement of local conditions during implementation of reform. Educators and administrators who are committed to effecting equity among inequitably distributed resources, such as high-quality teachers, will find Hanushek and Rivkin 2010, which draws on secondary analysis of Texas data, an interesting examination of how accountability measures and teacher-quality requirements affect the teacher labor market and, thus, the implementation of standards-based reform designs. Decision makers and professional development leaders, including school and teacher leaders, should turn to Starkey, et al. 2009 to read an empirical study of the traits of professional development that teachers found best met their operationally focused professional development needs during the final, or embedding, phase of a nationwide reform. The authors recommend that professional development be structured to meet the varying needs of teachers throughout the phases of implementation. Van den Bergh, et al. 2014 applies a video-based professional development program with the characteristics that support teacher learning, including active learning and feedback, to examine whether teachers in sixteen Dutch primary schools improved their feedback during active learning. The authors found that the teachers did change beliefs and behaviors, but the changes varied among participants and were neither significant nor consistent during implementation. Likewise, practitioners will be interested in four additional resources because they discuss findings from subject-matter research studies that address teachers' knowledge and support needs during implementation processes. Liang, et al. 2015 (cited under Addressing Learning Outcomes) emphasizes the importance of fidelity to implementation, while Atteberry and Bryk 2011 examines coaching and theorizes about individual and school factors that contribute to variations in teacher exposure to coaching within and between schools. Marsh, et al. 2008 and Supovitz and Turner 2000 treat the role of interplay and of interactions between coaches and subject matter teachers with regard to literacy and science. Killion 2015 proposes learner-focused feedback as a process for professional learning rather than a product of accountability.

Atteberry, A., and A. S. Bryk. 2011. Analyzing teacher participation in literacy coaching activities. *Elementary School Journal* 112.2: 356–382.

A longitudinal study of 250 teachers in seventeen schools showed school factors that influenced teacher engagement in coaching. Teachers with a sense of responsibility toward fellow teachers participated in more coaching regardless of the school's size. Principal support of professional development also correlated with more coaching.

Hanushek, E. A., and S. Rivkin. 2010. The quality and distribution of teachers under the No Child Left Behind Act. *Journal of Economic Perspectives* 24.3: 133–150.

Examines potential effects of test-based accountability measures and teacher-quality requirements on the quality of teachers, composition of new teachers, and dynamics of the teaching labor market, including decisions about hiring and termination. Authors analyze data from Texas, a strong accountability state before the adoption of No Child Left Behind.

Killion, J. 2015. *The feedback process: Transforming feedback for professional learning*. Oxford, OH: Learning Forward.

This book weaves several strands of literature to describe "learner-focused feedback," which shifts the focus from feedback-as-product to feedback-as- process. This concept of feedback provides professional learning that will improve practice. Includes multiple tools, templates, and examples of new approaches to feedback.

Marsh, J. A., J. S. McCombs, J. R. Lockwood, et al. 2008. *Supporting literacy across the sunshine state: A study of Florida middle school reading coaches*. Santa Monica, CA: RAND.

This monograph analyzes survey, interview, and case-study data to assess facets of Florida's coaching program and implementation from state to classroom levels. Evidence is mixed regarding the impact of coaching on achievement, although the frequency with which coaches reviewed assessment data with teachers was associated with positive outcomes.

Rimm-Kaufman, S., R. Larsen, A. Baroody, et al. 2014. Efficacy of the Responsive Classroom approach: Results from a 3-year, longitudinal randomized controlled trial. *American Educational Research Journal* 51.3: 567–603.

A three-year, randomized controlled trial study demonstrates that, when implemented with high levels of fidelity, the Responsive Classroom approach results in achievement gains in reading and math for fifth graders in schools participating in the intervention for three years.

Starkey, L., A. Yates, L. H. Meyer, et al. 2009. Professional development design: Embedding educational reform in New Zealand. *Teaching and Teacher Education* 25:181–189.

This mixed-methods evaluation research examines teacher perspectives during the final phase, or embedding, of a national reform. Focused on local operational adjustments during this phase, professional development aspects that teachers rated most highly were personalized learning, subject area collegial networks, and skilled facilitation.

Supovitz, J. A., and H. M. Turner. 2000. The effects of professional development on science teaching practices and classroom culture. *Journal of Research in Science Teaching* 37.9: 963–980.

This analysis of professional development activities uses hierarchical linear modeling to examine school-level effects separately from the contribution of individual teachers' experiences in professional development. It discusses professional development features that matter most in the domain of science for fostering the use by teachers of inquiry-oriented instructional materials.

Van den Bergh, L., A. Ros, and D. Beijaard. 2014. Improving teacher feedback during active learning: Effects of a professional development program. *American Educational Research Journal* 51.4: 772–809.

After participating in a video-based professional development program incorporating features needed for effective teacher learning (e.g., active, collaborative, feedback, reflection), sixteen teachers in upper primary grades in the Netherlands showed changes in beliefs, perceived problems, and goal-directed feedback behaviors. Authors conjecture why no consistent, sustained change occurred.

Outcomes

Professional learning that increases educator effectiveness and results for all students aligns its outcomes with educator performance and student curriculum standards. The conceptual framework of the outcomes standard encompasses the following core elements: (1) meeting performance standards, (2) addressing learning outcomes, and (3) building coherence. The references were chosen for all subsections because they reflect the research base for the core elements of the standard and because of the authority of the researchers. The research studies and conceptual essays examine the nature of instruction and various learning outcomes, including teacher knowledge.

Meeting Performance Standards

The first core element, meeting performance standards, has been addressed in the literature for the past sixteen years. Graduate students and professional development facilitators will want to read the foundational reviews that address the first element: Newmann, et al. 1995 argues that all instruction should be rooted in high standards, and Zemelman, et al. 1998 reviews instruction options for several subject matters. Corcoran and Goertz 1995, a review of education economics, identifies certain components of the instructional capacity a school staff needs to achieve high-quality, or standards-based, instruction.

Corcoran, T., and M. Goertz. 1995. Instructional capacity and high performance schools. *Educational Researcher* **24.9: 27–31.**

This article reviews education economics research to define capacity as the maximum production of a school or education system if the product is high-quality instruction. Instructional capacity consists of the intellectual ability, knowledge, and skills of the faculty; the quality and quantity of resources available for teaching; and the social organization of instruction.

Newmann, F., H. Marks, and A. Gamoran. 1995. *Authentic pedagogy: Standards that boost student performance.* **Issues in Restructuring Schools 8. Madison, WI: Center on Organization and Restructuring Schools.**

This report posits that all instructional activities must be rooted in a primary concern for high standards of intellectual quality. It includes general criteria for authentic pedagogy as well as specific standards that can be used to judge the quality of assessment tasks, classroom lessons, and student performance.

Zemelman, S., H. Daniels, and A. Hyde. 1998. *Best practice: New standards for teaching and learning in America's schools.* **2d ed. Portsmouth, NH: Heinemann.**

Analyzes research and exemplary practice of the time in a summary of "best practice" research for each of six teaching fields: reading, writing, mathematics, science, social studies, and fine arts. After describing each field's research base, the authors give examples showing how teachers implemented content and processes in classrooms.

Addressing Learning Outcomes

Kennedy 1998 is one of the works that covers the second core element, addressing learning outcomes. In the article, the author discusses the challenges of documenting empirically the relationship between different types of knowledge, including teacher specialized knowledge of subject matter and teacher practice. Despite, or perhaps because of its logical presumption, that set of links has continued to be called for in research reviews such as Borko 2004. Developing a fine-grained understanding of the links among professional development, teacher learning and applications to teacher practice, and student outcomes has proved difficult because of the complexity of context and the limitations of research studies, as Yoon, et al. 2007 demonstrates. Within a synthesis of more than 1,340 studies, the authors found that only nine met the rigorous standards set by the US Department of Education. In reviewing the nine well-designed research studies, the researchers found evidence of positive impact on student achievement when teachers had professional development experiences that (1) included extended workshops or summer institutes; (2) focused principally on ideas gained through the involvement of outside experts; (3) included thirty or more contact hours; (4) included significant amounts of structured and sustained follow-up after the main professional development activities; and (5) determined structural features based on the specific content involved, the nature of the work, and the context in which that work took place. Liang, et al. 2015 is an international

study comparing the professional learning opportunities of US teachers with teachers in other countries and the effects of teacher professional learning on student achievement. The literature has been especially limited relative to the effect of teacher professional development aimed at improving achievement for diverse students. It has, therefore, continued to be called for in research works, such as Desimone 2009 (cited under Data), and tested in the works of other researchers, such as Gallimore, et al. 2009; Saunders, et al. 2009 (cited under Teachers' Learning Communities); and Griffith, et al. 2010 (cited under Data). Although those studies take place in Title I elementary and early childhood compensatory programs, the literature of effective professional development is limited in its examination of the teacher learning-teacher practice link relative to minority student outcomes. Sleeter 2011 goes some way toward filling that gap in a study that focuses on minority, secondary student participants. And although the Te Kotahitanga professional development program evaluated in Sleeter 2011 focused on Maori students, its findings are relevant to other school settings with diverse student bodies. Practitioners will want to read other works relevant to the second core element, such as Borko 2004, a review of professional learning research, and Shulman 2000, a work that provides a framework of teacher knowledge domains that draws on the research of cognitive development. Timperley and Alton-Lee 2008 identifies a wide range of situations of professional learning that are strongly related to positive outcomes for diverse student learners.

Borko, H. 2004. Professional development and teacher learning: Mapping the terrain. *Educational Researcher* **33.8: 3–15.**

Borko reviews professional development research: existence proof, effects of defined programs, and effects of multiple programs. She also suggests future research in investigating the adaptability of successful programs in one subject area to other subjects, studying scaling up small programs that are effective; and examining the trade-offs between fidelity and adaptation to ensure multisite program effectiveness.

Kennedy, M. 1998. Education reform and subject matter knowledge. *Journal of Research in Science Teaching* **35:249–263.**

This important research review identifies the knowledge that K-12 teachers need, according to reform documents of the time. Kennedy raises two problems: the lack of research on fostering and measuring teachers' deep understanding and the lack of evidence about how knowledge contributes to teaching practice. Since the time of publication, math and science researchers have been addressing these issues.

Liang, G., Y. Zhang, H. Huang, S. Shi, and Z. Qiao. 2015. Professional development and student achievement: International evidence from the TIMSS data. *Journal of Postdoctoral Research* **3.2: 17–31.**

Using fourth- and eighth-grade mathematics data from 2003, 2007, and 2011 Trends in International Mathematics and Science Study (TIMSS) assessments, researchers found US students had access to more teachers with professional development than students in other countries, but one-third to one-half of fourth-graders were taught by teachers without professional development.

Shulman, L. S. 2000. Teacher development: Roles of domain expertise and pedagogical knowledge. *Journal of Applied Developmental Psychology* **21.1: 129–135.**

This article applies cognitive sciences to discuss distinctions and interactions among areas of teacher knowledge. Shulman describes domains, including general pedagogical knowledge, profound subject-matter knowledge, and pedagogical content knowledge, or knowledge about how best to teach particular subject matter. The author outlines implications for professional development.

Sleeter, C. S., ed. 2011. *Professional development for culturally responsive and relationship-based pedagogy.* **Black Studies and Critical Thinking 24. New York: Peter Lang.**

This large-scale evaluation study addresses an internationally relevant issue: improving conditions of teaching and learning for minority students. Chapters discuss findings about relationships among culturally responsive pedagogy, professional development supporting changes in teacher practice, and student outcomes in twenty-two of thirty-three schools implementing a theory-based reform initiative.

Timperley, H. S., and A. Alton-Lee. 2008. Reframing teacher professional learning: An alternative policy approach to strengthening valued outcomes for diverse learners. *Review of Research in Education* **32:328–369.**

The authors trace the global rise in attention paid to policies concerning the role played by teacher knowledge for improving outcomes for diverse learners. Drawing on their best evidence synthesis (BES) of international research, the authors describe relationships of professional learning experiences to positive student outcomes. The learning situations that produced the greatest gains deepened teachers' pedagogical content and assessment knowledge.

Yoon, K. S., T. Duncan, S. W. -Y. Lee, B. Scarloss, and K. Shapley. 2007. *Reviewing the evidence on how teacher professional development affects student achievement.* **Issues & Answers Report, REL 2007–No. 033. Washington, DC: Regional Educational Laboratory Southwest.**

In the most comprehensive literature synthesis of professional development to date, researchers found that teachers who received intensive, long-term (average forty-nine hours) professional development contributed to student increase in achievement scores. Given the overall lack of rigor of reviewed studies, authors confirm the challenges in linking intensive, sustained, content-focused professional development to student achievement.

Building Coherence

The third core element, building coherence, is addressed in the remaining resources. Blank, et al. 2007 analyzes twenty-five professional development initiatives to identify characteristics of effective programs, including coherence. Cohen and Hill 2000, a study of mathematics, shows positive relationships when coherence exists between and among tests, curriculum, and instructional practices and when teachers have the time and opportunity to learn practices implied by standards, tests, and policies.

Blank, R. K., N. de las Alas, and C. Smith. 2007. *Analysis of the quality of professional development programs for mathematics and science teachers: Findings from a cross-state study.* **Washington, DC: Council for Chief State School Officials.**

This cross-state analysis, based on a study sample of twenty-five professional development initiatives across fourteen states, used a common rubric developed from recent research on program effectiveness. Researchers identified the following characteristics of effective programs: content focus, active learning, collective participation, coherence, sufficient time, and evaluation.

Cohen, D., and H. Hill. 2000. Instructional policy and classroom performance: The mathematics reform in California. *Teachers College Record* **102.2: 294–343.**

This study shows that state policy has a constructive influence on math education in the elementary grades when there is consistency among the tests and other policy instruments, the curricula, and other instruments of classroom practices and when teachers have substantial opportunities to learn the practices proposed by the policy.

back to top